REMARKS

Independent Claims 1, 28, 38 and 39 have been amended to recite that the foam is soft and flexible, and has a compression resistance of about 20% compression set or less. This amendment is supported on p. 11 lines 21-23.

Dependent Claim 5 has been amended to delete the generic term "graft copolymers" while still reciting ethylene-propylene-diene terpolymer (which is a specific graft copolymer).

The impact of the amendment to the independent claims is to illustrate that the foam has very little resistance to compression or bending, when exposed to a shock or other force.

The previous claim rejections have been withdrawn except for one rejection. Claims 1, 2 and 5-39 remain rejected under 35 U.S.C. § 103(c) as obvious over U.S. Patent 6,093,751 ("Federico") in view of U.S. Patent 6,268,046 ("Miller"). This rejection is respectfully traversed.

a) Federico Does Not Disclose A Soft, Flexible Foam As Claimed

The Examiner opines that Federico discloses "high impact polystyrene thermoplastic elastomer" in amounts of up to 30% by weight. The Examiner further opines that it would have been obvious to substitute di-block and tri-block copolymers disclosed in Miller, into the composition of Federico. However, Federico does not disclose or suggest a soft, flexible foam having a compression resistance of about 20% compression set or less.

Federico discloses a foam composition containing up to 30% "shock resistant polystyrene, preferably a dispersion of polybutadiene in polystyrene such as, for example, ENICHEM's product EDISTAR SR 550®." The Examiner is correct in characterizing this resin as "high impact polystyrene" (see accompanying Technical Data Sheet for EDISTAR® SR 550, Exh. A). On the other hand, high impact polystyrenes occupy a separate status in the art from typical thermoplastic elastomers, and do not result in the claimed softness or compression resistance.

High impact polystyrene ("HIPS") is described in the "Concise Encyclopedia Of Polymer Science And Engineering," Wiley & Sons (1990), pp. 1121-1122

(Exh. B, attached). HIPS is made by dissolving a small amount of rubber (e.g. polybutadiene) in a polystyrene matrix, chemically reacting (grafting) the polystyrene chains and the rubber, and chemically crosslinking the rubber. HIPS alleviates the brittleness of conventional polystyrene by providing a polymer having increased elongation, ductility and environmental stress crack resistance (Exh. B, p. 1121). HIPS is used in various injection molding and extrusion processes for making toys, appliance parts, packaging and furniture (Exh. B, p. 1122).

Yet HIPS does not contain enough rubber to impart softness as would an elastomer. When HIPS is stretched, it exhibits "stress whitening" and "decrease in density," both occurring "without lateral contraction" (Exh. B, p. 1121). HIPS contains just enough grafted and crosslinked rubber to overcome the brittleness associated with polystyrene, provide improved impact strength and some elongation.

Federico teaches that the HIPS added is a "shock-resistant polystyrene" (Col. 3, lines 16-21). Shock resistance may be a desirable attribute in the art of polystyrene food trays, to which Federico is directed. Food trays need to be fairly rigid and inflexible, and able to withstand impact when dropped.

However, the property of shock resistance is a <u>contrary</u> attribute when compared to Applicants' absorbent foam. Applicants' claimed foam is soft, flexible, and has a compression resistance of about 20% compression set or less. This means that the claimed foams have <u>very little</u> compression resistance, contrary to the foam trays of Federico which are treated with <u>shock-resistant</u> HIPS.

Notably, materials such as HIPS which stress-whiten during elongation, with reduced density and no narrowing, typically require very significant forces to achieve the elongation. The addition of HIPPS, while improving shock resistance, would not cause the polystyrene trays to be soft and flexible, with minimal compression resistance. Federico discloses that the main purpose of adding HIPS is to improve the absorbent capacity (Col. 3, lines 16-21).

b) Federico Teaches Away From Rapid Fluid Intake

Even though the polystyrene tray is described as "absorbent," Federico does not describe an absorbent foam having a fluid intake flux of about 1 ml/sec/in^2 or greater, for each of three insults, as required by Applicants' claims. First, a rapid fluid intake is not

needed for absorbent food trays. Liquid tends to pool gradually in food trays, and can be absorbed gradually. Second, Federico focuses on absorbent capacity yet contains no suggestion of rapid fluid absorption. Third, Applicants have compared the fluid intake flux of a representative inventive foam with that of a commercial absorbent polystyrene meat tray. As shown in Table 8 on page 34 of Applicants' specification, the absorbent polystyrene meat tray had a fluid intake flux of only 0.2 or 0.1 ml/sec/in^2 following each of three fluid insults. The representative invention foam had fluid intake flux of 6.5, 2.4 and 1.9 ml/sec/in^2, respectively, following each of the three insults.

By contrast, Federico teaches away from these properties by designing the absorbent meat tray to facilitate a slow, controlled absorption of aqueous liquids. Federico covers the absorbent foam with a water-repellent plastic film having small, spaced apart openings (Col. 4, lines 16-22). The water-repellent film prevents meat liquids from wetting the inner surface of the tray and creating unpleasant smells. Instead, meat liquids such as blood pass through the small openings in a controlled fashion and penetrate the underlying absorbent layer only through the holes (Col. 4, lines 28-33). If Federico were concerned about rapid fluid intake flux, there would be little or no inclination to cover the foam with a restrictive water-repellent film having small, spaced-apart holes.

c) Miller Does Not Fill The Voids In The Federico Disclosure

As explained previously, Miller discloses a closed cell foam which does not contain more than 55% open cells as required by Applicants' claims. As stated at Col. 9, lines 27-34 of Miller:

> The resultant foam bodies generally contain a major amount of closed cells and a minor amount of open cells. The relative amount of closed cells can be determined, for example, according to ASTM D2856-A. In one embodiment, more than about 70% of the cells of the resultant foam bodies are closed cells. In another embodiment, more than about 80% of the cells of the resultant foam bodies are closed cells. In a preferred embodiment, more than about 90% of the cells of the resultant foam bodies are closed cells. In a more preferred embodiment, more than about 95% of the cells of the resultant foam bodies are closed cells.

Closed cell foams are typically nonabsorbent or have very little absorbency, because it is impossible for liquid to penetrate the closed cells. Accordingly, the foams of Miller are used for nonabsorbent applications such as foam boards and foam insulation (Col. 8, lines 46-49). Miller does not disclose a foam which has a fluid intake flux of about

1 ml/sec/in^2 or more upon receiving each of three insults, as required by Applicants' claims.

Miller discloses that an elastomeric rubber can be added to facilitate processing of the foamable mixture in an extruder and enhance relaxation of the resulting foam bodies (Col. 7, lines 18-37). However, the resulting foam bodies (e.g., foam boards and foam structures) reflect applications where a rigid or hard foam may be useful, as opposed to one which is soft and flexible. Accordingly, the amount of elastomeric rubber is limited to about 0.1-10 parts by weight of elastomeric rubber for every 100 parts by weight of styrene base polymer (Col. 7, lines 32-38). This means that the elastomeric rubber can be used at up to 10/110, or about 8.9% of the combined weight of styrenic base polymer and elastomeric rubber.

Miller does not disclose a foam having 10% to about 50% by weight of a thermoplastic elastomer as required by Applicants' claims. The claimed elastomer content helps the inventive foam to have softness, resiliency and a high percentage of open cells, all of which facilitate use of the foam as an absorbent member in a personal care absorbent article. Miller does not disclose this type of foam. The foam boards and other foam bodies of Miller are not designed for use in diapers, training pants, swimwear, feminine hygiene articles or other personal care absorbent articles.

d) There Is No Suggestion To Combine The References

There is no suggestion in the art to combine Federico with Miller. The former is directed to absorbent meat trays having shock resistance. The latter is directed to nonabsorbent, closed-cell foam bodies useful for foam boards and foam insulation. The technologies of the two references are so divergent from one another that persons skilled in the art would have no motivation to combine the references <u>absent a specific suggestion in the art to do so</u>. There is no suggestion in the art to combine these references.

To the contrary, an elastomer other than HIPS (which causes shock resistance) would undermine the objectives of Federico by rendering the food trays too soft and flexible for their intended purpose. Prior art cannot be combined where the combination would undermine the objectives of the primary reference.

e) **Conclusion**

For these reasons, the claim rejection based on Federico in view of Miller should be withdrawn.

Applicants believe that the claims, as presented, are in condition for allowance. If the Examiner detects any unresolved issue, then Applicants' attorney maintains the previous request for a telephone call from the Examiner, and a telephone interview.

Respectfully submitted,

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POLIMERI EUROPA

Edistir®

Polystyrene

SR 550

TECHNICAL DATA SHEET

Product description

High impact, easy flow polystyrene with good elasticity at low temperatures.

Suitable for injection moulding of large or complex parts with low thickness and high impact strength.

Designation: Thermoplastics ISO 2897-PS-I,M,083-12-07-18

Applications

Toys, housewares, technical items.

Typical processing data

Injection moulding:
- predrying normally not required
- melt temperature 200-250°C
- mould temperature 20-60°C

General information

SR 550 is certified UL94 HB "all colors" at 1.5 mm (UL file E83071).

This grade in its natural version complies by composition with the requirements set by the main Regulations for plastic materials intended for food contact (including the EEC Directive 90/128 and subsequent amendments).

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Edistir® SR 550

Polystyrene

Properties	Test conditions	Test methods	Units	Values
General				
Density		ISO 1183	g/cm³	1.04
Bulk density		ISO 60	g/cm³	0.65
Water absorption	24 h - 23°C	ISO 62	%	<0.1
[illegible]				
Melt flow rate	200°C - 5 kg	ISO 1133	g/10 min	11
Mechanical				
Tensile stress at yield	50 mm/min	ISO 527	MPa	18
Tensile stress at break	50 mm/min	ISO 527	MPa	17
Tensile strain at break	50 mm/min	ISO 527	%	55
Tensile modulus	1 mm/min	ISO 527	MPa	1700
Flexural strength	2 mm/min	ISO 178	MPa	32
Izod impact strength, notched	+23°C - thickness 3.2 mm	ISO 180/4A	J/m	110
	+23°C - thickness 4 mm	ISO 180/1A	kJ/m²	9
	-30°C - thickness 4 mm	ISO 180/1A	kJ/m²	6.5
Rockwell hardness	L/M scale	ISO 2039/2	-	L60
[illegible]				
Vicat softening temperature	10 N - 50°C/h	ISO 306/A	°C	90
	50 N - 50°C/h	ISO 306/B	°C	82
Deflection temperature under load (annealed)	1.8 MPa - 120°C/h	ASTM D 648	°C	81
Coefficient of linear thermal expansion		ASTM D 696	10^{-5}/°C	9
Thermal conductivity		ISO 8302	W/(K·m)	0.17
Moulding shrinkage		internal method	%	0.4 - 0.7
[illegible]				
Flame behaviour	thickness 1.5 mm	UL 94	class	HB
Glow wire test (GWT)	thickness 1.6 mm	IEC 60695-2-1	°C	650
[illegible]				
Surface resistivity		IEC 60093	ohm	>1.5·10E+15
Volume resistivity		IEC 60093	ohm·cm	>7·10E+15
Comparative tracking index (CTI)	solution A	IEC 60112	-	500
Dielectric strength		IEC 60243	kV/mm	65
Dielectric constant (relative permittivity)	50 Hz	IEC 60250	-	2.5
Dissipation factor	50 Hz	IEC 60250	-	3·10E-4

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All indicated data refer to natural grades.
The data, information and suggestions are provided for guidance purposes only.
The Company accepts no responsibility for the results obtained therefrom, as neither for their utilization in infringement of possible patent rights.
However the Company will provide the guaranteed values for each product on demand.

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EXHIBIT B

ble 1. Properties of Conventional and Specialty Commercial Grades of HIPS[a]

ıperties[b]	ASTM test method	Extrusion	Injection molding	High heat	High melt flow	High gloss	ESCR[c]	IR[d]
ron resins[e]		484	479	492U	410	8028	469R	6061
lt flow rate[f], g/10 min	D1238	3.0	7.5	3.0	13.5	3.5	2.5	5.0
at softening point, °C	D1525	100	94	104	94	103	101	102
lection temperature under load at 1.8 MPa[g], °C	D648	92	82	96	81	88		
sile rupture, MPa[g]	D638	16.6	15.9	20.7	17.9	23.0	17.2	15.2
sile yield, MPa[g]	D638	17.9	18.6	22.1	22.8	25.5	13.8	20.0
sile modulus, MPa[g]	D638	1655	1793	1793	2207	2241		1862
ngation, ·	D638	40	40	40	20	20	30	25
xural modulus, MPa[g]	D790	1931	1793	1793	2276	2138		
xural strength, MPa[g]	D790	38.6	32.4	41.7	42.8	51.7		
tched Izod at 23°C, J/m[h]	D256	80.1	85.5	85.5	37.4	122.8	74.7	74.7
rdner impact,[i] cm·kg		138	121	173	29	173		34.6
ckwell hardness	D785							
L scale		73	65	66	88	85		
M scale		29	25	40	65	45		
ecific gravity	D792	1.05	1.05	1.05	1.05	1.05	1.05	1.16
ıer companies with product[j]		ACFHMP	ACFHMP	CFHMP	ACFHMP	M		H

ata supplied by The Dow Chemical Company.
ll test specimens were prepared by compression molding.
nproved ESCR resin.
R = ignition-resistant grade. Additives do not make these polymers noncombustible, but rather increase their resistance to ignition and reduce the rate of urning on minor fire sources. The organic resin material is flammable and will burn under proper conditions of heat and oxygen supply.
he Dow Chemical Company trademark.
est condition G; 200°C/5 kg.
o convert MPa to psi, multiply by 145.
o convert J/m to ft · lb/in, divide by 53.38.
cm diameter × 0.32 cm thickness.
, Amoco Chemicals Corp.; C, Chevron Corp. (Gulf); H, Huntsman Chemical Corp.; F, American Petrofina, Inc.; M, Mobil Oil Corp.; P, Polysar Ltd.

ı the premise that rubber particles both initiate and control raze growth.

Rubber-toughened styrenics other than HIPS exhibit simar, but not identical, behavior. Most rubber-reinforced yrene–acrylonitrile copolymer (ABS) resins, eg, deform by a ıore complicated mechanism. Both stress whitening (crazing) nd necking (shear yielding) are observed. The growth of crazes . controlled by both rubber particles and the developing shear and, with the rubber particles playing the primary role.

These mechanisms explain the failure of fabricated articles ıbjected to instantaneous large deformations. Molded parts lso fail because of repeated cyclic loads. This type of failure as been described as fatigue. Much recent research has foused on developing an understanding of the fatigue failures f polymers (see FATIGUE).

roperties of HIPS

tandard HIPS materials are used in both injection molding nd extrusion processes. Generally, resins with low melt visısity (melt flow rate (MFR) greater than 3) are used for inection-molding applications; resins with high melt viscosities MFRs less than 3) are more suitable for extrusion applications. ypical end uses are toys, appliance parts, packaging, and ırniture. These applications require property improvements ver polystyrene, such as increased impact strength and ducllity. A balance of flow and heat resistance is needed, but ptical clarity is not required. Table 1 lists typical properties ır extrusion, injection-molding, high heat, high melt flow, igh gloss, ESCR, and ignition-resistant HIPS resins. The specific physical properties in this table are representative of the grades of resins available from various manufacturers.

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ENVIRONMENTAL STRESS CRACKING

The premature fracture of polymers at stresses considerably below the nominal yield stress, while in contact with aggressive environments, is a well-established observation and a practical engineering problem (see CRAZING). This process is a result of enhanced craze growth and breakdown under load and under the influence of an agent that is often only mod-

mercially available polystyrene–PPE blends are shown in le 2 (see also POLY(PHENYLENE ETHERS).

ds of Polystyrene with Elastomers

of the most successful blends is that of polystyrene and block rubbers. The combination usually results in an ecoical material with modest impact resistance, but low haze. act strength reaches a maximum at about 40 wt % styrene he copolymer elastomer.

olystyrene–SB blends can be fabricated by several methinjection molding, blow molding, blown film, and sheet usion. The morphology and properties are greatly depent on fabrication conditions, with higher shear fields yielding ller particles (Table 3).

le 3. Properties of Polystyrene Blends[a] with styrene–SB Block Copolymers

	Stereon 974[b]	KR05[c]
styrene, %	50	40
impact (method B), g	315	350
flex (0.046-cm specimen),	250	500
lding endurance, cycles to failure		
ic modulus, MPa[d]	104	106
ile at yield, MPa[d]	36	36
gation (1.3 cm/min), %	<10	<15

ruded sheet.
stone Synthetic Rubber and Latex Co. (multiblock, 70% styrene).
llips Petroleum Co. (radial block).
onvert MPa to psi, multiply by 145.

ds of SAN and ABS with PC

mercial products based on PC and ABS blends were inuced several years ago and have gained popularity among fabricators. The principal macromolecular components mmiscible with one another. Despite the immiscibility, an llent balance of properties occurs in the region of 35–65 % PC.

nother study of the effect of processing conditions on the phology of the fabricated part showed that the final blend phology is determined primarily by the last fabrication . The best morphology is a colamellar state achieved with 5 vol % PC. The toughness of PC–ABS blends is optimized a colamellar state is achieved (see also POLYCARBONATES).

(styrene-co-maleic anhydride) Blends

terpolymers of styrene–maleic anhydride–acrylonitrile, ene–maleic anhydride–methyl methacrylate, styrene–ic anhydride–ethyl acrylate, and styrene–maleic anide–isobutylene have been blended with ABS resins and properties determined. Blending maleic anhydride termers with ABS allows the potential of increased solvent tance, toughening, modified processibility, and improved distortion properties.

ls of Polystyrene with Polyethylene

crystalline nature of polyolefins is responsible for a very change in viscosity at the melting point. This forces the cator to take special measures when attempting to thermoform these resins. The potential fabrication benefits from blending with polystyrene have encouraged many studies in both industrial and academic laboratories.

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HIGH IMPACT POLYSTYRENE

Polystyrene and styrene copolymers are noted for their high tensile strength and optical clarity, but they are brittle under many normal use conditions. Rubber modification opens up many markets unavailable to unmodified polystyrene.

Synthesis

Commercial high impact polystyrene (HIPS) products are made by polymerization of an unsaturated rubber dissolved in styrene in a solution or mass-suspension process. The rubber, generally polybutadiene, is dispersed throughout the polystyrene matrix in the form of discrete particles.

The rubber-in-styrene polymerization usually results in a superior product when compared with blended products; that is, higher modulus and equivalent impact strength are achieved with less rubber. The property improvement is due to a chemical interaction (grafting) between the growing polystyrene chains and the rubber, chemical cross-linking of the rubber, and occlusion of the continuous-phase polymer inside the rubber particles, which increases the effective volume of the rubber phase. Rubber reinforcement produces other physical property improvements such as increased elongation, ductility, and environmental stress crack resistance (ESCR). These improvements in the composite polymer are accompanied by loss of clarity and a large decrease in tensile strength and modulus from the unmodified polymer.

Morphology

Many electron microscopy techniques have been developed for evaluating morphology. The differences in structure among the HIPS resins are primarily a result of differences in production processes, types of rubber, and rubber concentrations. Most commercial HIPS resins have particle sizes ranging from about 1 to 10 μm.

Mechanism of Rubber Reinforcement

The role of rubber in reinforcing glassy polystyrene and the mechanism of rubber particle formation have been described in detail. For HIPS the multiple craze theory seems to best explain the elongation, impact, and tensile properties of the resin, including stress whitening and the decrease in density that occurs without lateral contraction. This theory is based

EXHIBIT B

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